GAM Run 10-031 MAG

by Jerry Shi, Ph.D.

Texas Water Development Board
Groundwater Availability Modeling Section
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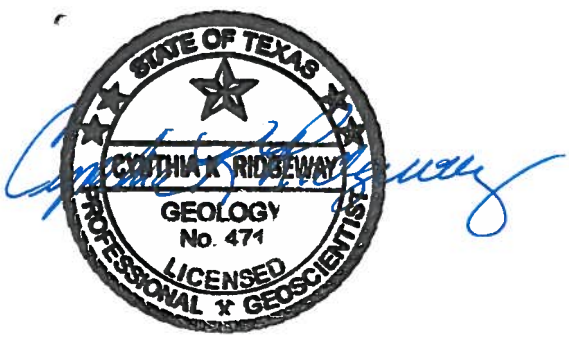
December 7, 2011



Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on December 7, 2011.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Ogallala Aquifer as result of the desired future conditions adopted by the members of Groundwater Management Area 6 is shown divided by county, regional water planning area, and river basin in Table 1 for use in the regional water planning process. Modeled available groundwater is summarized by county, river basin, and groundwater conservation district in tables 2 through 4. The estimates were based on Groundwater Availability Modeling Task 10-023 (Scenario 3), which meets the desired future conditions for the Ogallala Aquifer adopted by the members of Groundwater Management Area 6.

The modeled available groundwater from the Ogallala Aquifer in Groundwater Management Area 6 that meets the desired future conditions declines from approximately 22,300 acre-feet per year in 2010 to 21,200 acre-feet per year in 2060 (Table 4). The modeled available groundwater in the Gateway Groundwater Conservation District declines from approximately 9,900 acre-feet per year to 9,600 acre-feet per year over the same time.

REQUESTOR:

Mr. Mike McGuire, General Manager of Rolling Plains Groundwater Conservation District, on behalf of Groundwater Management Area 6

DESCRIPTION OF REQUEST:

In a letter dated August 13, 2010, Mr. McGuire provided the Texas Water Development Board (TWDB) with the desired future conditions of the Ogallala Aquifer in Groundwater Management Area 6. The desired future conditions for the Ogallala Aquifer, as described in Resolution No. 2010-002 and adopted July 22, 2010 by the groundwater conservation districts within Groundwater Management Area 6, is described below:

> *The Desired Future Condition for Motley County, located in the Gateway Groundwater Conservation District, is that condition whereby 50 percent of the current volume in storage will remain in 50 years (2060)*
>
> *The Desired Future Condition for Dickens County, not located within a Groundwater Conservation District, is that condition whereby 50 percent of the current volume in storage will remain in 50 years (2060)*

In response to receiving the adopted desired future conditions, the Texas Water Development Board has estimated the modeled available groundwater for the Ogallala Aquifer in Groundwater Management Area 6.

METHODS:

The previously completed predictive groundwater availability model simulation of the Ogallala Aquifer, documented as Groundwater Availability Modeling (GAM) Task 10-023 (Scenario 3), meets the desired future conditions adopted by the members of Groundwater Management Area 6 for Dickens and Motley counties (Oliver, 2010). This model simulation used the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer (Blandford and others, 2003; Blandford and others, 2008). The results presented in this report were taken directly from this simulation. See GAM Task 10-023 for a full description of the methods, assumptions and results of the groundwater availability model simulation (Oliver, 2010).

MODELED AVAILABLE GROUNDWATER AND PERMITTING:

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from "managed available groundwater," shown in the draft version of this report dated November 30, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Ogallala Aquifer in Groundwater Management Area 6 consistent with the desired future conditions declines from approximately 22,300 acre-feet per year in 2010 to 21,200 acre-feet per year in 2060. This has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1). The modeled available groundwater is also summarized by county, river basin, and groundwater conservation district as shown in tables 2, 3, and 4, respectively.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing

the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Blandford, T.N., Blazer, D.J., Calhoun, K.C., Dutton, A.R., Naing, T., Reedy, R.C., and Scanlon, B.R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico—Numerical simulations through 2050: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 158 p.

Blandford, T.N., Kuchanur, M., Standen, A., Ruggiero, R., Calhoun, K.C., Kirby, P., and Shah, G., 2008, Groundwater availability model of the Edwards-Trinity (High Plains) Aquifer in Texas and New Mexico: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 176 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Oliver, W., 2010, Texas Water Development Board, GAM Task 10-023 Model Run Report, 27 p.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 1. Modeled available groundwater for the Ogallala Aquifer in Groundwater Management Area 6. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Region	Basin	Year					
			2010	2020	2030	2040	2050	2060
Dickens	O	Brazos	5,939	5,939	5,939	5,939	5,939	5,939
		Red	6,400	6,400	6,400	6,181	6,181	5,655
Motley	O	Red	9,936	9,936	9,936	9,936	9,936	9,576
Total			**22,275**	**22,275**	**22,275**	**22,056**	**22,056**	**21,170**

Table 2. Modeled available groundwater for the Ogallala Aquifer by county for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Dickens	12,339	12,339	12,339	12,120	12,120	11,594
Motley	9,936	9,936	9,936	9,936	9,936	9,576
Total	**22,275**	**22,275**	**22,275**	**22,056**	**22,056**	**21,170**

Table 3. Modeled available groundwater for the Ogallala Aquifer by river basin for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	5,939	5,939	5,939	5,939	5,939	5,939
Red	16,336	16,336	16,336	16,117	16,117	15,231
Total	**22,275**	**22,275**	**22,275**	**22,056**	**22,056**	**21,170**

Table 4. Modeled available groundwater for the Ogallala Aquifer by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year.

District	Year					
	2010	2020	2030	2040	2050	2060
Gateway GCD	9,936	9,936	9,936	9,936	9,936	9,576
No District	12,339	12,339	12,339	12,121	12,121	11,594
Total	**22,275**	**22,275**	**22,275**	**22,056**	**22,056**	**21,170**

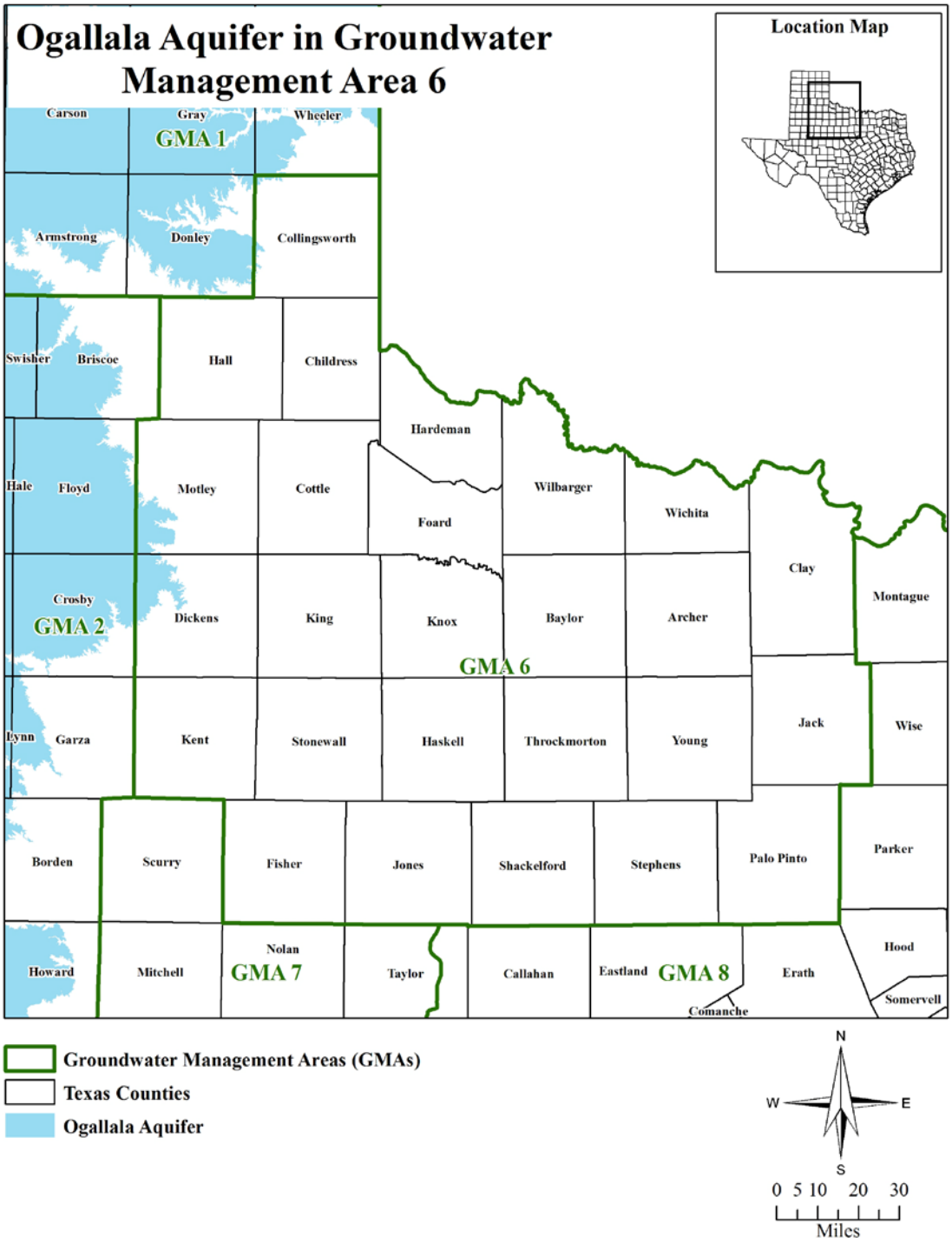

Figure 1. Map showing Groundwater Management Area 6 and the boundary of the Ogallala Aquifer according to the 2007 State Water Plan (TWDB, 2007).

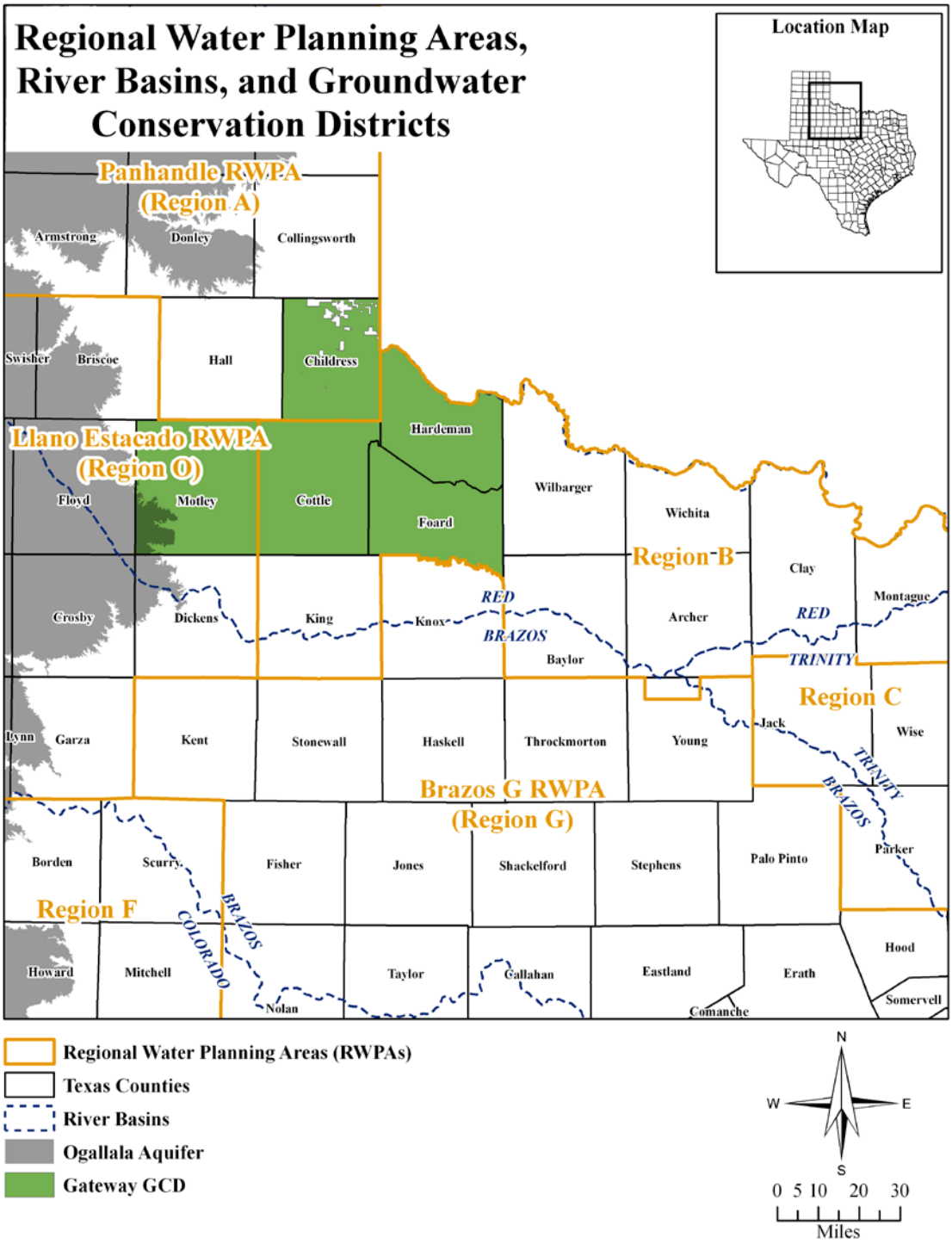

Figure 2. Map showing Gateway Groundwater Conservation District (GCD), regional water planning areas, counties, and river basins in and neighboring Groundwater Management Area 6.